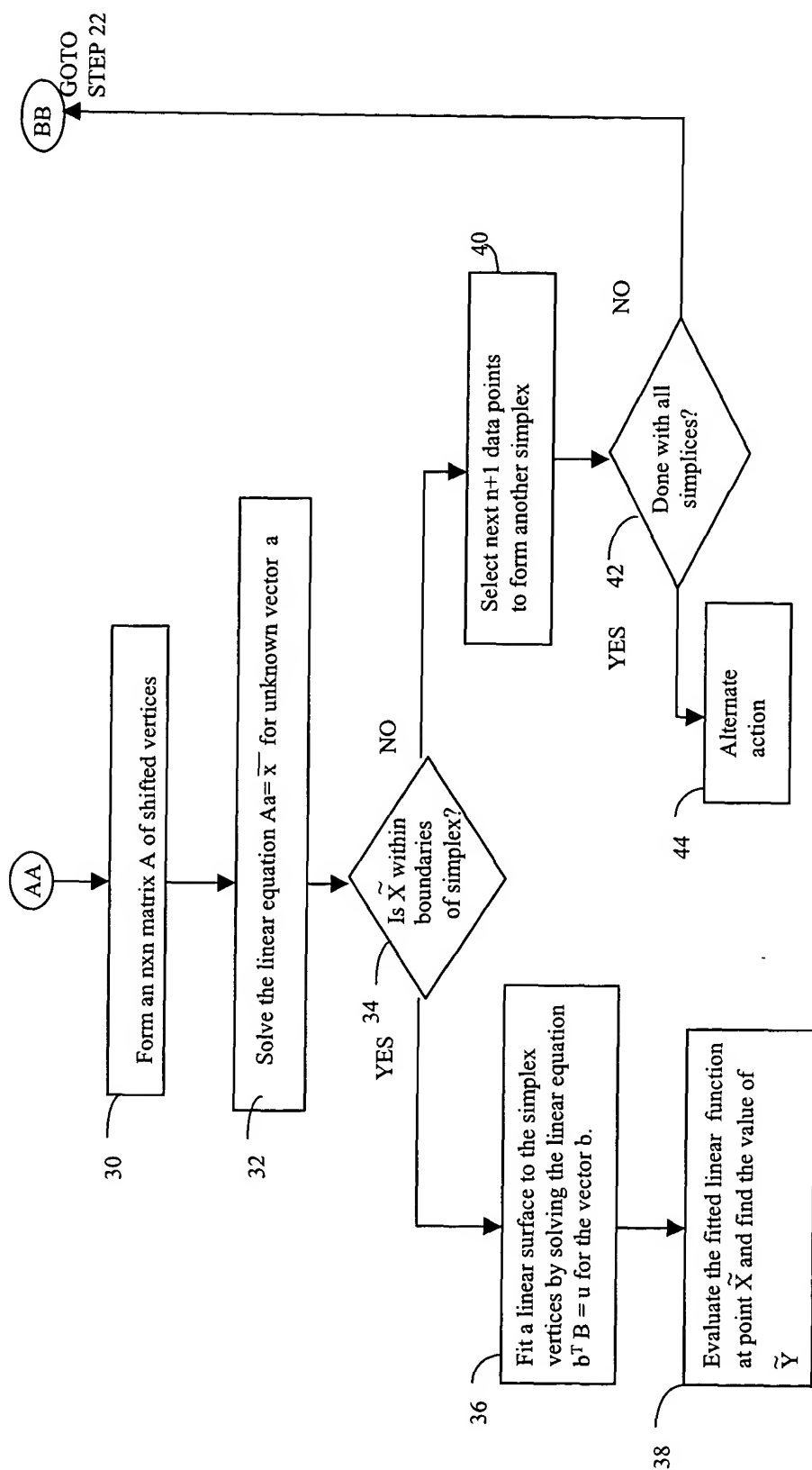Title: **METHOD AND APPARATUS FOR FAST INTERPOLATION OF MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA SETS**

Inventor: Radoslaw Romuald Zakrzewski   Filed: July 31, 2003
Agent: Anne E. Saturnelli   Reg. No.: 41,290
Docket No.: BFM-01501   **Sheet 1 of 8**

12 — Obtain a set of experimental data points and corresponding scalars representing the values of each data point evaluated according to an unknown function.

14 — Select first data point from data set
Select interpolation data point $\tilde{X}$

16 — Done with all data points?

NO

26 — Determine distance between $\tilde{X}$ and each data point in the experimental data set.

28 — Get next data point from data set

YES

18 — Sort distances

20 — Select the n+K lowest distance values, K>1

22 — Select first combination of n+1 points as vertices of a simplex

24 — Shift the coordinate system to have the first vertex as the point of origin

BB

GO TO STEP 30

AA

10

FIGURE 1

Title: **METHOD AND APPARATUS FOR FAST INTERPOLATION OF MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA SETS**

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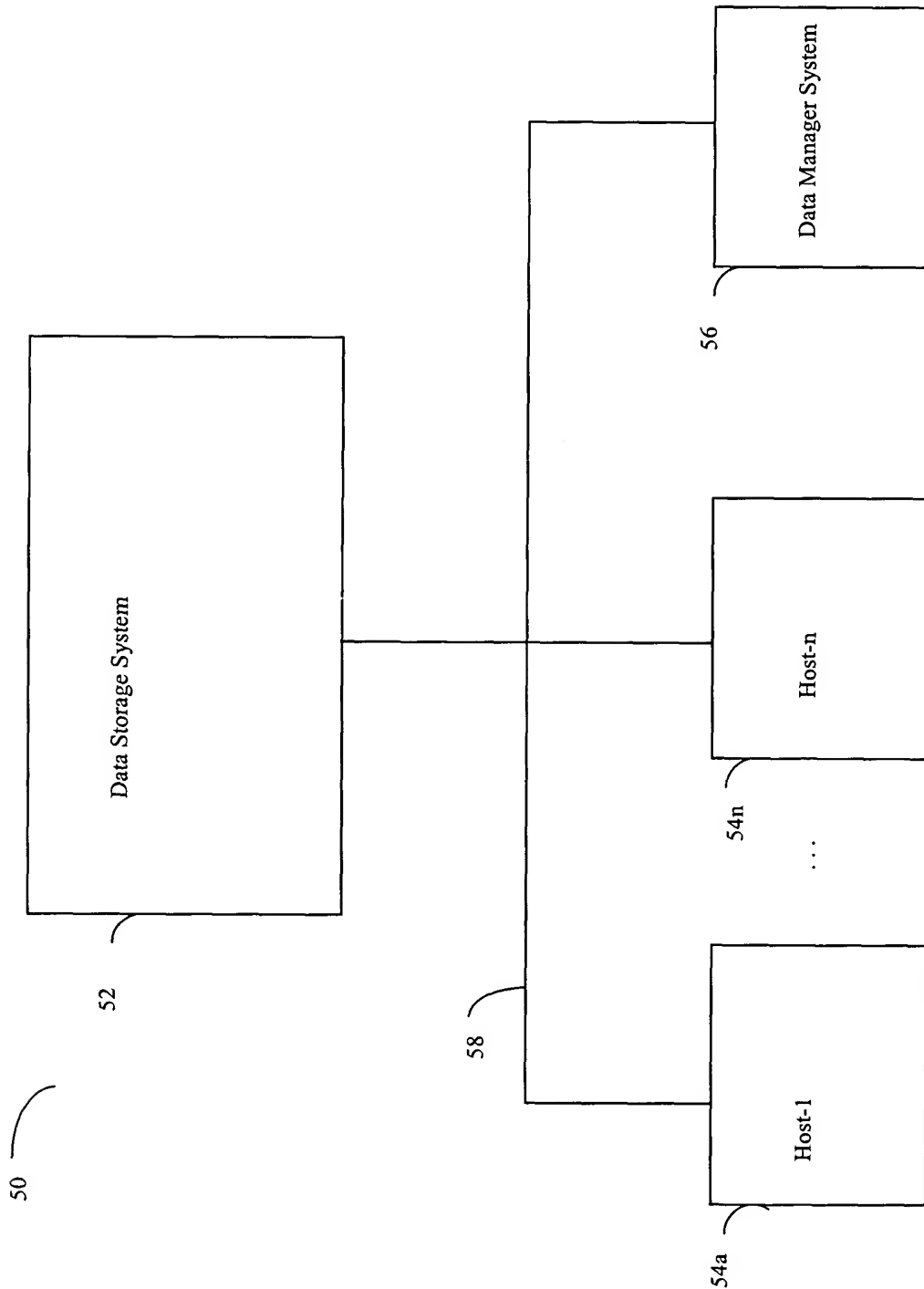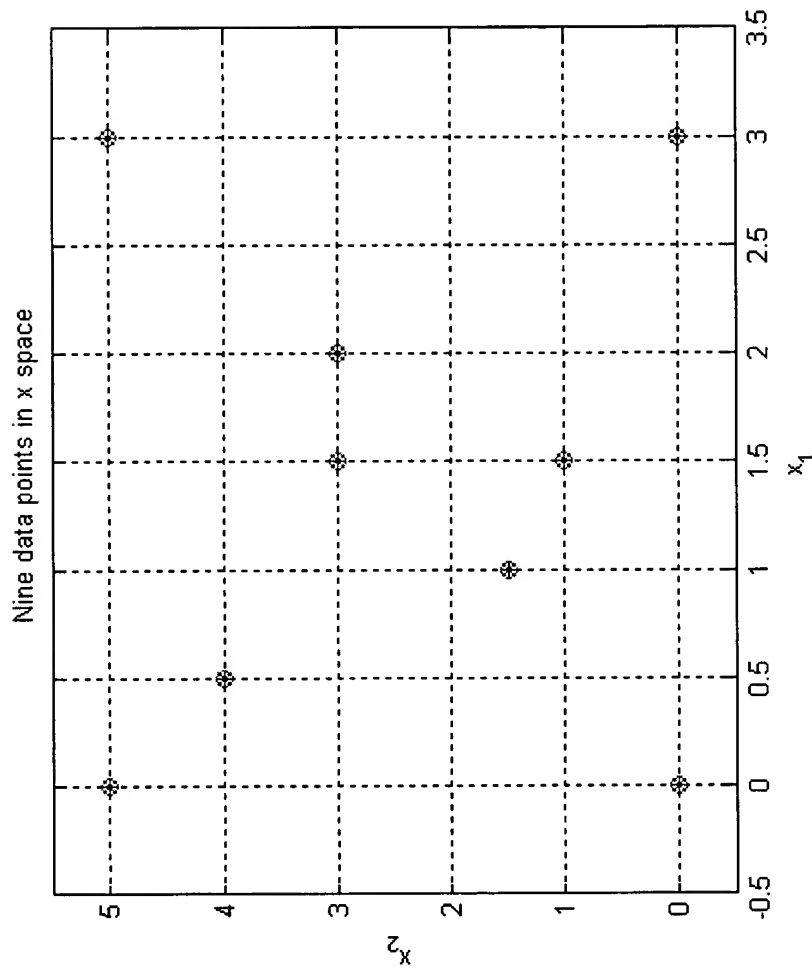Filed: July 31, 2003

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(AA) → Form an nxn matrix A of shifted vertices — 30

→ Solve the linear equation $Aa = \overline{x}$ for unknown vector a — 32

→ Is $\tilde{X}$ within boundaries of simplex? — 34

NO → Select next n+1 data points to form another simplex — 40

→ Done with all simplices?

NO → (BB) GOTO STEP 22

YES 42 → Alternate action — 44

YES 34 → Fit a linear surface to the simplex vertices by solving the linear equation $b^T B = u$ for the vector b. — 36

→ Evaluate the fitted linear function at point $\tilde{X}$ and find the value of $\tilde{Y}$ — 38
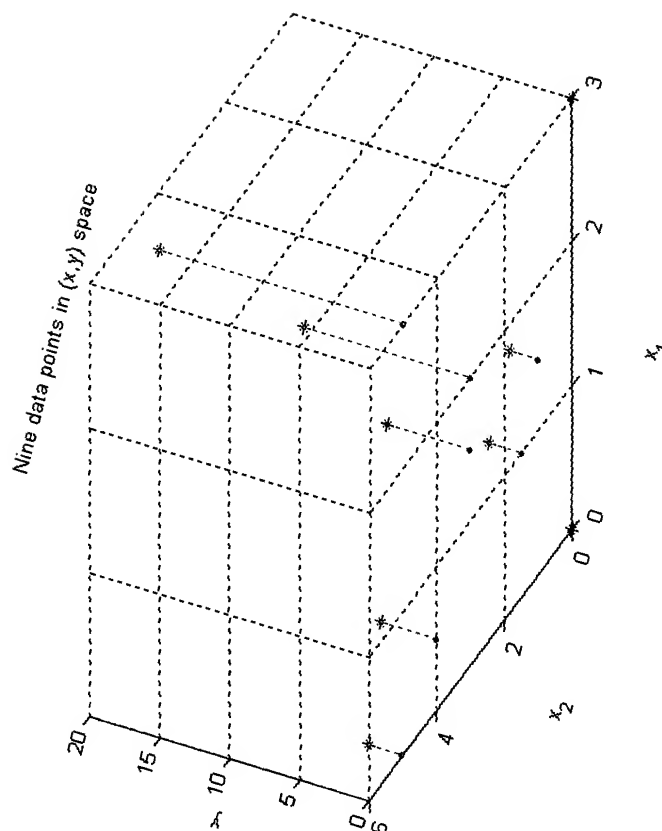
FIGURE 2

Title: METHOD AND APPARATUS FOR FAST INTERPOLATION OF
MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA
SETS
Inventor: Radoslaw Romuald Zakrzewski   Filed: July 31, 2003
Agent: Anne E. Saturnelli   Reg. No.: 41,290
Docket No.: BFM-01501   **Sheet 3 of 8**

FIGURE 3

Title: METHOD AND APPARATUS FOR FAST INTERPOLATION OF
MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA
SETS

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Nine data points in x space

FIGURE 4

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FIGURE 5

Title: METHOD AND APPARATUS FOR FAST INTERPOLATION OF
MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA
SETS

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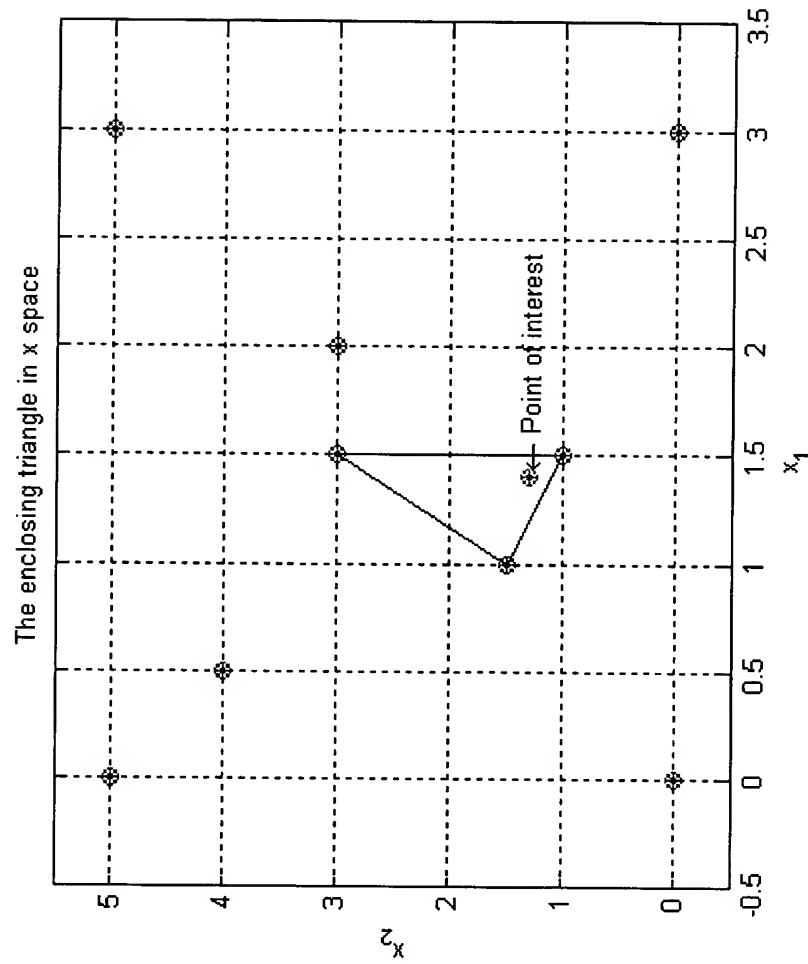Filed: July 31, 2003
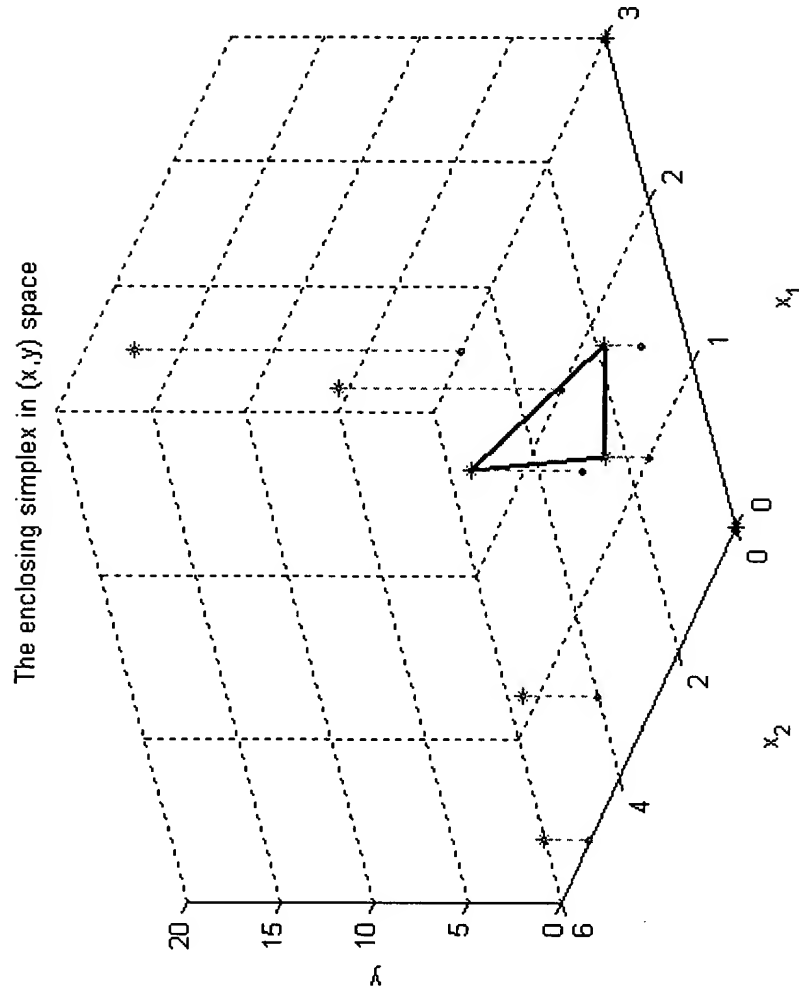Reg. No.: 41,290
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FIGURE 6

Title: METHOD AND APPARATUS FOR FAST INTERPOLATION OF
MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA
SETS
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Agent: Anne E. Saturnelli   Reg. No.: 41,290
Docket No.: BFM-01501   **Sheet 7 of 8**

FIGURE 7

Title: **METHOD AND APPARATUS FOR FAST INTERPOLATION OF MULTI-DIMENSIONAL FUNCTIONS WITH NON-RECTANGULAR DATA SETS**
Inventor: Radoslaw Romuald Zakrzewski
Agent: Anne E. Saturnelli
Docket No.: BFM-01501

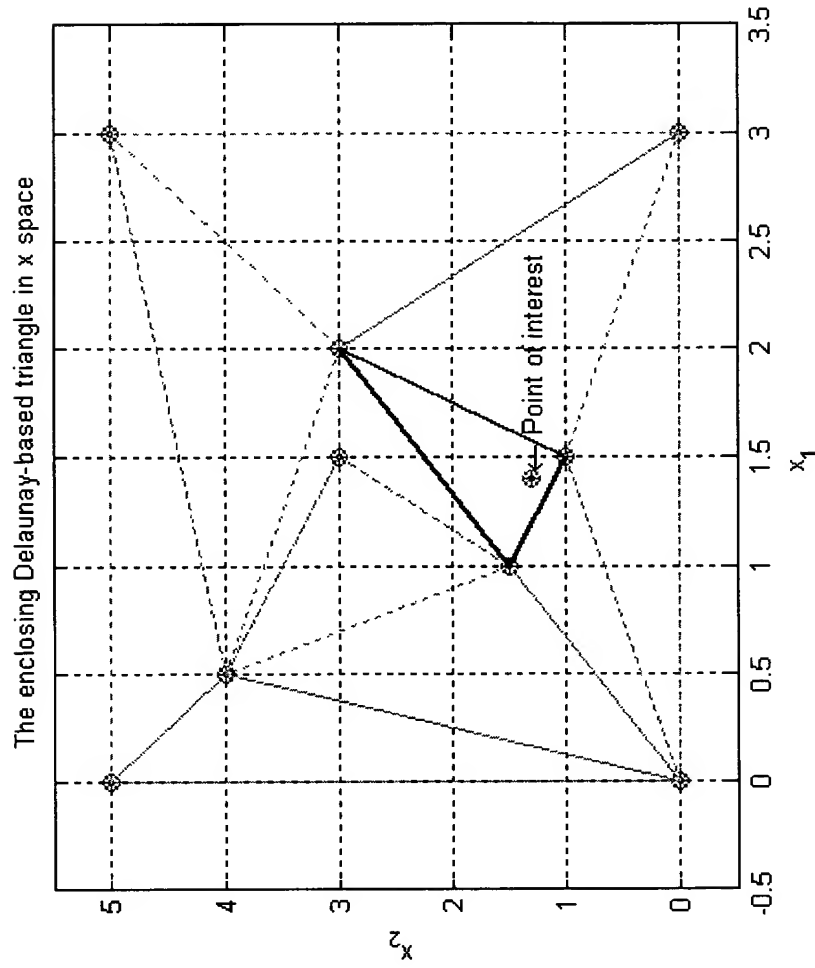Filed: July 31, 2003
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The enclosing Delaunay-based triangle in x space

Point of interest

x_1

x_2

400

FIGURE 8